## IN THE CLAIMS

## We claim:

1. A transistor comprising:

a channel region formed from a narrow bandgap semiconductor film formed on insulating substrate;

a gate dielectric formed on said low bandgap semiconductor film;

a gate electrode formed on said gate dielectric; and

a pair of source/drain regions formed from a semiconductor film having a wider bandgap than said low bandgap semiconductor film formed on opposite sides of said gate electrode and adjacent to said low bandgap semiconductor film.

- 2. The transistor of claim 1 wherein said narrow bandgap semiconductor film has a bandgap of less than or equal to 0.7 eV.
- 3. The transistor of claim 1 wherein said narrow bandgap semiconductor film comprises InSb.
- 4. The transistor of claim 2 wherein said low bandgap semiconductor film is selected from the group consisting of InAs, PdTe and InSb.
- 5. The transistor of claim 1 wherein said gate dielectric comprises a high dielectric constant film.
- 6. The transistor of claim 1 wherein said source and drain regions are formed from a III-V semiconductor.

- 7. The transistor of claim 1 wherein said gate electrode is a metal gate electrode.
- 8. The transistor of claim 1 wherein the bandgap of said semiconductor film of said source/drain regions is at least 0.2 eV greater than the bandgap of said channel region.
- 9. The transistor of claim 1 wherein said semiconductor film of said source/drain regions is selected from the group consisting of InAISb, InP, GaSb, GaP, and GaAs.
- 10. A transistor comprising:
- a channel region formed from narrow bandgap semiconductor film formed on an insulating substrate;
  - a gate dielectric formed on said narrow bandgap semiconductor film;
  - a gate electrode formed on said gate dielectric; and
- a pair of metal source/drain regions formed along opposite sides of said gate electrode and adjacent to said narrow bandgap semiconductor film.
- 11. The transistor of claim 10 wherein said low bandgap semiconductor film has a bandgap of less than or equal to 0.7 eV.
- 12. The transistor of claim 10 wherein said low bandgap semiconductor film is selected from the group consisting of InAs, PdTe and InSb.
- 13. The transistor of claim 10 wherein said source/drain regions are formed from a material selected from the group consisting of titanium nitride, tantalum nitride and hefium nitride.
- 14. The transistor of claim 10 wherein said source/drain regions are formed from a metal film which can form a Schottky barrier with said low bandgap semiconductor film.

- 15. The transistor of claim 10 wherein said metal film is selected from the group consisting of platinum, aluminum and gold.
- 16. The transistor of claim 10 wherein said gate dielectric has a dielectric constant greater than 9.0.
- 17. The transistor of claim 10 wherein said gate dielectric comprises a metal oxide dielectric.
- 18. The transistor of claim 10 wherein said gate dielectric layer is selected from the group consisting of PZT, BST, tantalum pentaoxide, hefium oxide, zirconium oxide and aluminum oxide.
- 19. The transistor of claim 10 wherein said gate dielectric layer has a thickness between 20-3000Å.
- 20. The transistor of claim 10 wherein said gate electrode comprises a metal film.
- 21. The transistor of claim 10 wherein said gate electrode has a midgap work function.
- 22. The transistor of claim 10 wherein said transistor has a gate length of less than or equal to 30 nanometers.
- 23. The transistor of claim 10 wherein said thickness of said low bandgap semiconductor film is approximately 1/3 the gate length of said transistor.

24. The transistor of claim 10 wherein said insulating substrate comprises a silicon dioxide film formed on a monocyrstalline silicon substrate.

## 25. A transistor comprising:

an InSb alloy film formed on an oxide film formed on a monocrystalline silicon substrate;

a gate dielectric layer formed on said InSb alloy film wherein said gate dielectric is a high dielectric constant film;

a metal gate electrode formed on said gate dielectric layer; and

a source region and a drain regions formed on opposite sides of said gate electrode adjacent to said InSb alloy film and on said oxide film, said source and drain regions formed from a metal film.

- 26. The transistor of claim 25 wherein said metal film is selected from a material which can form a Schottky barrier with said InSb alloy.
- 27. The transistor of claim 25 wherein said metal film is selected from the group consisting of titanium nitride, tantalum nitride and hefium nitride.

## 28. A transistor comprising:

an InSb alloy film formed on an oxide film formed on a monocrystalline silicon substrate;

a gate dielectric layer formed on said InSb alloy film wherein said gate dielectric is a high dielectric constant film;

a metal gate electrode formed on said gate dielectric layer; and

a source region and a drain regions formed on opposite sides of said gate electrode adjacent to said InSb alloy film and on said oxide film, said source and drain regions formed from a semiconductor film having a wide bandgap.

- 29. The transistor of claim 28 wherein said semiconductor film is selected from the group consisting of InP, GaSb, GaP, and GaAs.
- 30. The transistor of claim 28 wherein said gate dielectric is selected from the group consisting of PZT, BST, tantalum pentaoxide, hefium oxide, zirconium oxide and aluminum oxide.
- 31. A method of forming a transistor comprising:

  forming a narrow bandgap semiconductor film on an insulating substrate;

  forming a gate dielectric layer on said narrow bandgap semiconductor film;

  forming a gate electrode on said gate dielectric; and

  forming a pair of source/drain regions adjacent to said narrow bandgap semiconductor

  film.
- 32. The method of claim 31 wherein said narrow bandgap semiconductor film has a bandgap of less than or equal to 0.7 eV.
- 33. The method of claim 32 wherein said narrow bandgap semiconductor film is selected group consisting of InAs, PdTe and InSb.
- 34. The method of claim 32 wherein said source/drain regions are formed from a semiconductor film having a larger bandgap then said narrow bandgap semicomductor film.
- 35. The method of claim 31 wherein said source/drain regions are formed from a compound semiconductor.

- 36. The method of claims 34 wherein said semiconductor film of said source/drain regions is selected from the group consisting of InAISb, InP,GaSb, GaP, and GaAs.
- 37. The method of claim 31 wherein said source/drain regions are formed from a metal film.
- 38. The method of claim 37 wherein said metal film forms a Schottky barrier with said narrow bandgap semiconductor film.
- 39. The method of claim 37 wherein said metal film is selected from the group consisting of titanium nitride, tantalum nitride and hefium nitride.
- 40. The method of clam 31 wherein said gate dielectric layer comprises a deposited high dielectric constant film.
- 41. The method of claim 31 wherein said gate electrode comprises a metal film.
- 42. A method of forming a transistor comprising:

  forming an InSb alloy film on an insulating substrate;

  forming a high dielectric constant gate dielectric film on said InSb alloy film;

  forming a metal gate electrode on said gate dielectric layer; and

  forming a pair of source/drain regions on opposite sides of said gate electrode on said insulating substrate.
- 43. The method of claim 42 wherein said source/drain regions are formed from a metal film.
- 44. The method of claim 42 wherein said source/drain regions are formed from a wide bandgap semiconductor film.

- 45. A transistor comprising:
- a channel region formed from a narrow bandgap semiconductor film formed on insulating substrate;
  - a gate dielectric formed on said narrow bandgap semiconductor film;
  - a gate electrode formed on said gate dielectric; and
- a pair of source/drain regions formed on said insulating substrate and adjacent to opposite sides of said narrow bandgap semiconductor film.
- 46. The transistor of claim 45 wherein said source/drain regions are formed from a metal film.
- 47. The transistor of claim 45 wherein said source/drain regions are formed from a wide bandgap semiconductor film.